

NAVY PROGRAMS

DDG 51 Guided Missile Destroyer Including: AN/SPY-1D Radar and AN/SQQ-89 Integrated Surface Ship Anti-Submarine Warfare Combat System

The *Arleigh Burke* (DDG 51) class of guided missile destroyers is being constructed in groups, or flights, to incorporate technological advancements during construction. Flight I (DDG 51-71) and Flight II (DDG 72-78) configurations are described in previous reports. This report focuses on early Flight IIA ships with the AEGIS Baseline 6 Phase I computer program (DDG 79-84), which are now joining the Fleet. The AEGIS Weapon System (AWS), which includes the SPY-1D radar and SM-2 surface-to-air missiles, provides the ship's air defense capability. The Phalanx close-in weapon system, SM-2 missiles, and 5-inch gun provide self-defense against anti-ship missiles.

For undersea warfare (USW), DDG 51 uses the AN/SQQ-89 USW combat system, up to two embarked Light Airborne Multi-Purpose System (LAMPS) MK III helicopters, torpedoes, and vertically launched USW standoff weapons. Surface warfare weapons include the 5-inch gun and LAMPS MK III helicopters armed with Hellfire missiles. Tomahawk missiles and the 5-inch gun are used to engage shore targets. Links 4A, 11, and 16 provide connectivity to other Navy, Joint, and Allied forces.

The SPY-1D radar system is a multi-function, phased array, three-dimensional (range, altitude, and azimuth) radar that conducts search, automatic detection, and tracking of air and surface targets. The SPY-1D also transmits mid-course guidance commands for the SM-2 missile. AN/SPY-1D(V), a new variant under development for installation in later Flight IIA ships, is intended to improve performance against targets in clutter and to provide an enhanced capability to counter deceptive electronic attack measures.

The AN/SQQ-89(V) series of USW combat systems links acoustic sensors and weapon control systems with advanced data processing and information displays. The AN/SQQ-89(V)6, which is installed in Flight I and Flight II ships and other combatants, is the baseline system for ships with a towed array. It integrates the AN/SQS-53 series hull mounted sonar, the AN/SQR-19(V) Tactical Towed Array Sonar, and the AN/SQQ-28(V) LAMPS MK III shipboard electronics with the USW Control System MK 116 series. For Flight IIA ships, the AN/SQQ-89(V)10 removes the AN/SQR-19 towed array.

DOT&E's independent assessment of the Flight I Live Fire Test and Evaluation (LFT&E) Program will be included in the assessment of the Flight IIA LFT&E Program, scheduled for completion in September 2003. Flight II ship design survivability will be assessed as part of the Flight IIA LFT&E Program.

TEST & EVALUATION ACTIVITIES

Several tests were conducted on the operational effectiveness and suitability of AEGIS software baselines 5.3.8 and 6.1.3, and the USW capability of baseline 6.1.5. The mine detection capability of the AN/SQQ-89 KINGFISHER sub-system, carried in all DDGs, was also tested. The MK 45, MOD 4 gun mount and its accompanying MK160 MOD 8 gun computer system, outfitted on Flight IIA



The Arleigh Burke (DDG 51) class of guided missile destroyers is being constructed in groups, or flights, to incorporate technological advancements during construction.

NAVY PROGRAMS

destroyers beginning with DDG 81, underwent Initial Operational Test and Evaluation (IOT&E) in December 2002. Additionally, DOT&E was active in test and evaluation working groups involved in planning the tests completed in FY02, and designing the tests which will evaluate the performance of Flight IIA ships with AEGIS software baseline 6 Phase III in late FY03 or FY04. DOT&E also assisted in developing TEMP revisions for DDG 51, AN/SQQ-89(V), and AN/SPY-1D(V) programs. LFT&E activities were focused on reviewing preliminary results of the Flight IIA Total Ship Survivability Trial, Shock Trial and vulnerability assessment.

TEST & EVALUATION ASSESSMENT

As documented in prior-year reports, Flight I and II DDG 51 class ships and the AN/SPY-1D radar are assessed to be operationally effective and suitable.

DDG 51 Operational Test-III E was conducted on a not-to-interfere basis during a *John F. Kennedy* (CV 67) Battle Group training exercise. Since operational testers did not participate in exercise planning and had no control over exercise events, not enough useful data was generated to support a comprehensive evaluation of Flight IIA operational effectiveness.

The Flight IIA / Baseline 6.1.3 DDG 51 is effective in accomplishing the air defense mission. Except for a new computer program (AEGIS Baseline 6.1.3) and changes in the AEGIS Display System, the air defense configuration of the Flight IIA test ship was similar to that of Flights I and II. Simulated engagements of manned opposition aircraft during training exercises and data from live missile engagements prove the Flight IIA ship retains its air defense effectiveness.

The Flight IIA DDG 51 is effective in accomplishing the strike warfare mission. *USS Roosevelt* conducted 54 simulated Tomahawk Land Attack Missile (TLAM) engagements using the latest version of the Advanced Tomahawk Weapon Control System (ATWCS). ATWCS adequately supported all tasking including time-critical engagements.

Not enough data was generated during Operational Test-III E to support a conclusion about the effectiveness of Flight IIA in undersea warfare. Uncertainty in submarine position data precluded reconstruction of the engagements. Evaluation of Flight IIA undersea warfare effectiveness will continue in Operational Test-III F.

Flight IIA effectiveness against surface threats is untested. *USS Roosevelt* did not have an armed helicopter embarked during Operational Test-III E and there were no surface engagements. The armed helicopter is the Flight IIA ship's only weapon system capable of engaging surface threats beyond the horizon. DDG 51 gun weapon system effectiveness against surface craft has not yet been demonstrated in operational testing. The effectiveness of current variants of Standard Missile (SM-2) against surface threats is also unproven. These issues are being examined in Operational Test-III F.

Flight IIA survivability requires additional testing to evaluate susceptibility to realistic surface ship, submarine, and mine threats. Evaluation of joint interoperability has been deferred to Operational Test-III G to allow more time for developmental testing, identification of data collection requirements, refinement of measures of effectiveness, and development of analysis tools.

The Flight IIA/Baseline 6.1.3 DDG 51 tested during Operational Test-III E was not operationally suitable. Operational testers faulted the stability of the AEGIS Display System and identified a number of deficiencies in outfitting, logistics support, compatibility, safety, and documentation. Most deficiencies are minor. Major deficiencies included safety issues related to the limited storage space in the cramped helicopter hangars, inability to locate required technical documentation, and excessive AEGIS software restoration times. These issues will be reexamined in Operational Test-III F.

The DDG 51 Program Manager has a comprehensive database of deficiencies from all phases of Operational Testing and LFT&E and is aggressively pursuing identification of root causes and deficiency correction. This is an impressive, systematic program to verify correction of performance deficiencies discovered in testing. Other weapons systems would profit from a similar program and commitment. High priority changes are being injected into the ship construction program at the earliest economic opportunity and, subject to funding availability, will be retrofit into existing ships. Deficiencies that have been corrected are scheduled for reexamination in a future phase of Follow-On Test and Evaluation.